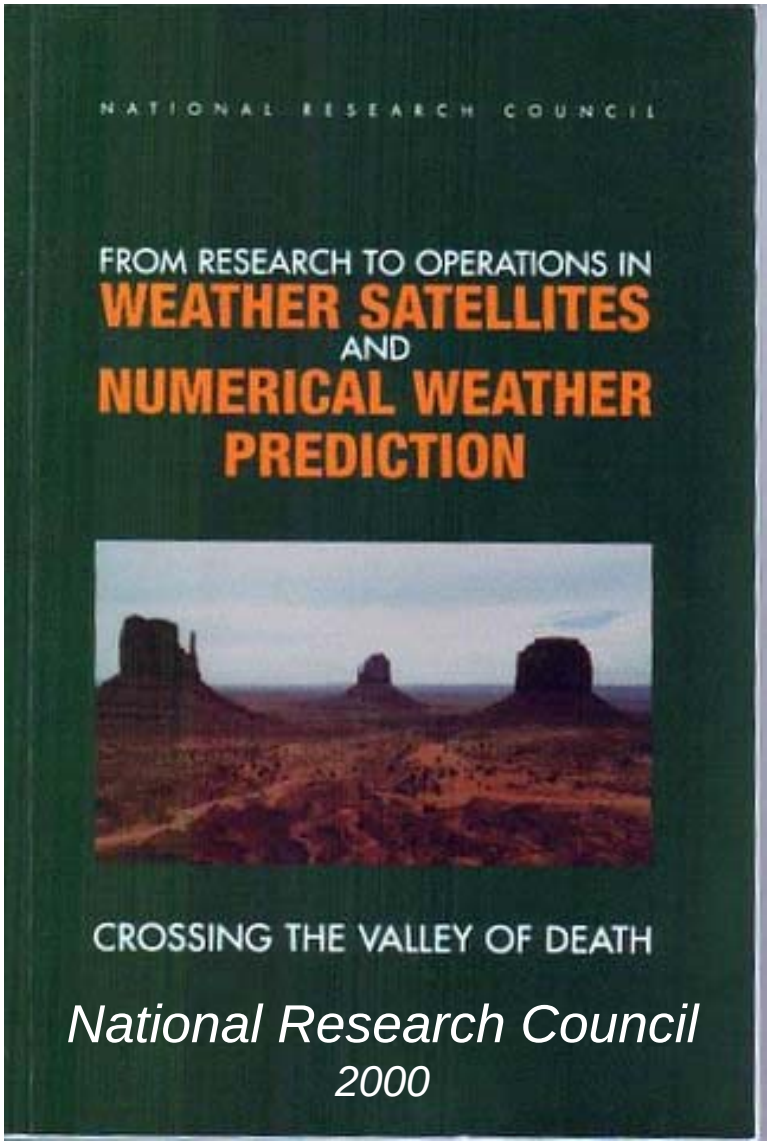
Bridging the Gap

Exploring the Barriers and Potential Solutions to Cross-jurisdictional Invasive Species Mapping, Documentation and Data Management

Barron J. Orr
Geospatial Extension Program
University of Arizona

September 6, 2007

The technology transfer challenge



"Crossing the Valley of Death"
is sometimes used in industry to describe the fundamental challenge of transitioning from research to implementation.

Unsuccessful crossings

The National Research Council report advises, that, if done improperly, transitions from research to implementation often result in "skeletons in the Valley of Death"

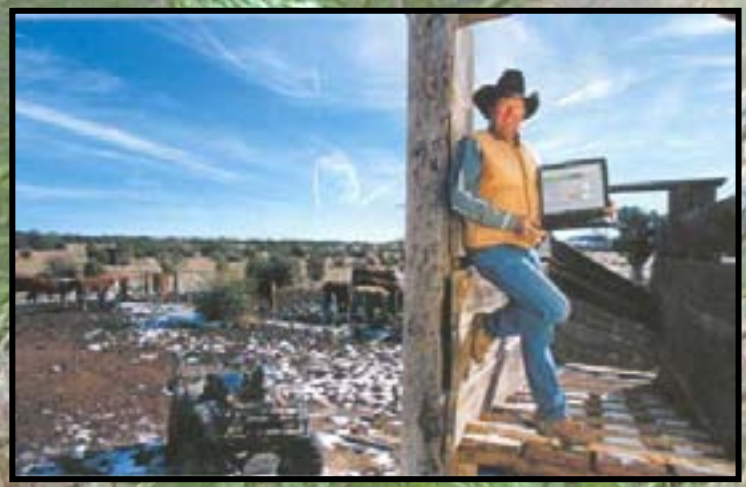
Successful crossings

- Require:
  - An understanding of the importance (and risks) of the transition
  - Development and maintenance of appropriate transition plans
  - Adequate resource provision
  - Continuous feedback (in both directions) between R&D and operational activities
  - Making outreach bidirectional: "*Inreach*"
- Recommend that AZ-ISMap employ a user-driven, adaptive R&D approach to help ensure a successful crossing!

National Research Council, 2000

The Geospatial Extension Program in Arizona

Bringing people and geospatial technology together



NASA USDA EDUCATION RESEARCH EXTENSION CSREES USGS ARIZONA COOPERATIVE EXTENSION

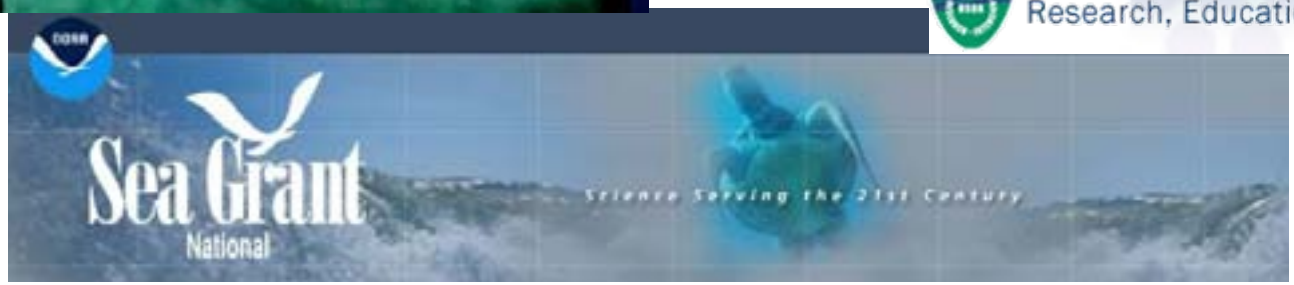
A Convergence of User Needs and Agency Missions

NASA

USDA
EDUCATION
CSREES
RESEARCH · EXTENSION

NOAA

CSREES
Cooperative State
Research, Education, and Extension Service



NGTEN

The mission of NGTEN is…

…to facilitate the practical use of Earth systems science and geospatial technology, and help meet the growing demand for a spatially literate workforce.

This is made possible through seeds sown by NASA, USDA and NOAA, and the networks provided by Land Grant (Cooperative Extension), Space Grant, Sea Grant and other local partners.

National Geospatial Technology Extension Network - Mozilla Firefox

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http://geospatialextension.org

http://www.geospatialextension.org/

Google

National Geospatial Technology Extension Network

Mission...

Our mission is to facilitate the practical use of Earth systems science and technology, and help meet the growing demand for a spatially literate workforce. This is made possible through seeds sown by NASA, USDA and NOAA, and the science and education networks provided by Land Grant (Cooperative Extension), Space Grant, Sea Grant and other local partners.

Alabama
Arizona
Connecticut
Mississippi
Missouri
Nebraska
New Hampshire
North Dakota
Ohio
Oklahoma
Rhode Island
Texas
Utah
Virginia

About Geospatial Extension | Outcomes and Impacts | Resources | Geospatial Technology | Applications

NASA CSREES NOAA

From Our Archives

Courtesy of Philip Rasmussen
Utah State University

Upcoming Events

ESRI International User Conference 2007
August 20-24, 2007

Website • More Info

URISA's 2007 Annual Conference
August 20-23, 2007
Washington, DC
Website • More Info

Full Calendar

Featured Program On Target

In each participating state, a Geospatial Extension Specialist (GES) acts as a knowledge broker, or the two-way conduit between research, applications development and practice. We build on existing Earth science capabilities, which include Earth observations from space, modeling and systems engineering, geographic information systems (GIS), the global positioning system (GPS) and spatial decision support systems (SDSS).

Factoid

NASA Learning Technologies: World Wind lets you zoom in from satellite altitude into any place on Earth.

Business strategy:

- Develop a cross-jurisdictional, interactive database and mapping system for invasive species in support of all levels of end-users interested in invasive species: “Arizona Invasive Species Map”.
- This business strategy requires organizational and infrastructure (in this case, IT) strategies working together to address AZ-ISMap objectives.

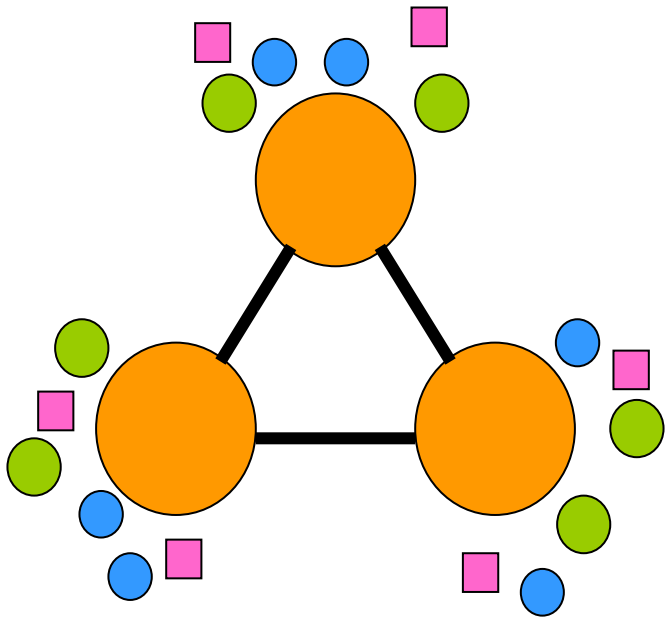
Organizational strategy

- *Facilitate collaboration across Arizona's invasive species community to stimulate more effective data/information sharing/use*
  - Existing providers & services
  - End-user functional needs/experience
  - Reach new users
  - Wide range of needs (e.g. those with legacy systems as well as those needing assistance in hosting data)
  - Foster further development of location-based web services by partner organizations and the user community

Organizational strategy: structure

- A network of organizations with brokers, coordinated by an umbrella entity

Key organizations (contributing developers and brokers)
Member organizations with legacy data provision systems
Member organizations who need assistance in hosting data
Member organizations with applications that use data



Information strategy

- *Provide accessible, interoperable invasive species data and service infrastructure.*
  - Provides reference/framework data and contextual data drawn from other domain systems
  - Leverages modular, reusable code from existing systems and encourages co-development and interoperability with other state-wide and regional services
  - Capable of “feeding” regional and national applications
  - Flexible enough to address barriers or constraints of participating organizations.
  - Anticipates future needs:
    - risk analysis, gap analysis and prioritization
    - life form (i.e., plants, animals, insects, diseases);
    - research and forecasting (conduit to third-party modeling and simulation tools)

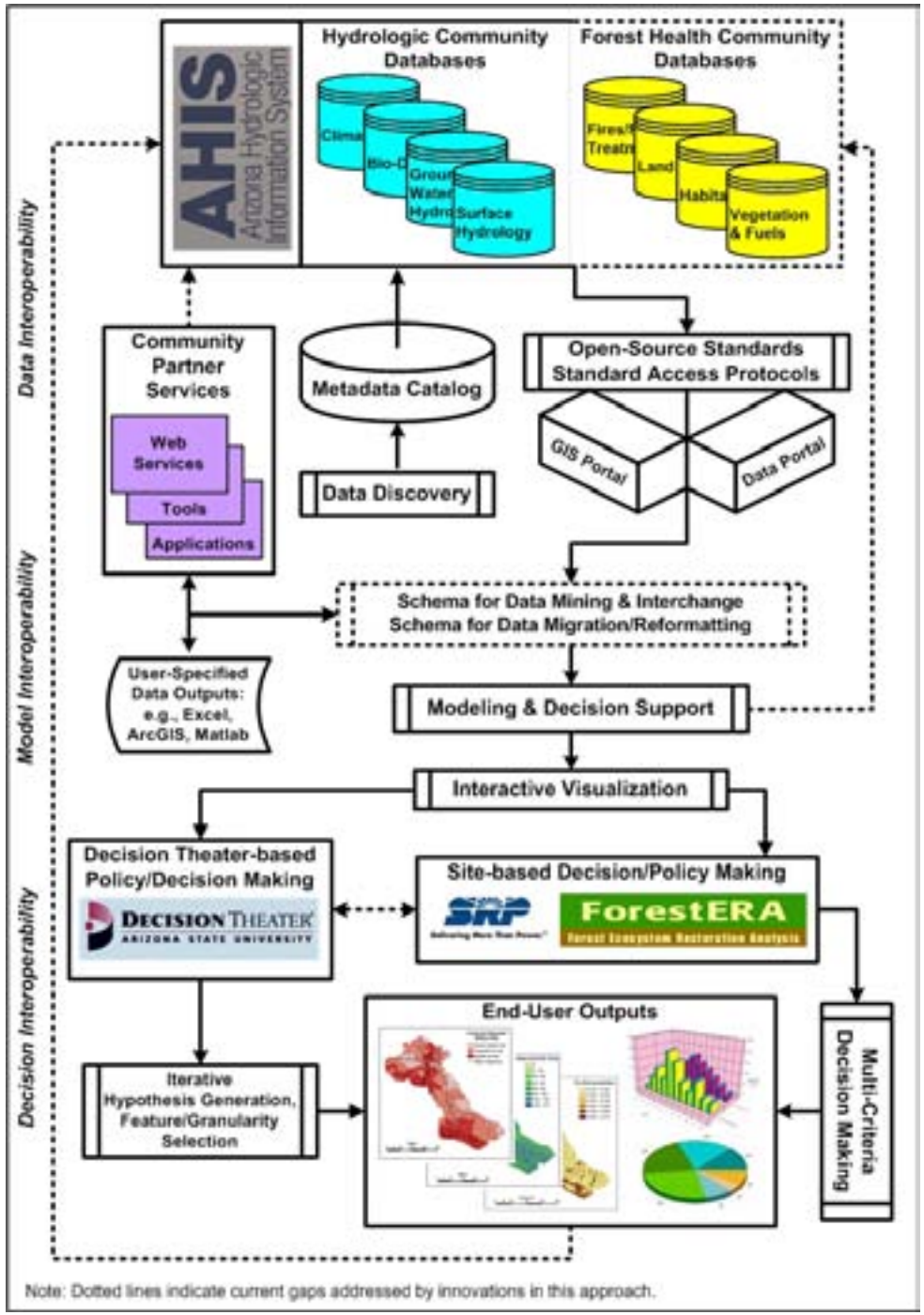
Information strategy

- *Develop a common database reflecting core standards*
  - Build the network which links/integrates related organizations
    - Support dynamic data and metadata communication between organizations
  - Develop the database schema based on user specifications
    - Primary and secondary attributes
    - Common (across member organizations) and unique attributes
  - Assess the functions required by users
  - Assess the reporting needs of users and decision makers
  - Note: this phase is significant, runs in parallel with the protocol and policy phase of the organizational strategy, and is almost always underestimated in terms of time and cost

Information & Organizational Strategies:

Pursuing Interoperability:

Combining the strengths of Arizona Water Institute (which is guiding a multi-organization effort to build the Arizona Hydrologic Information System (AHIS) and the Forest Health Council (which guided the development of an cross-organization fuels treatments Database called Arizona FIREMAP.



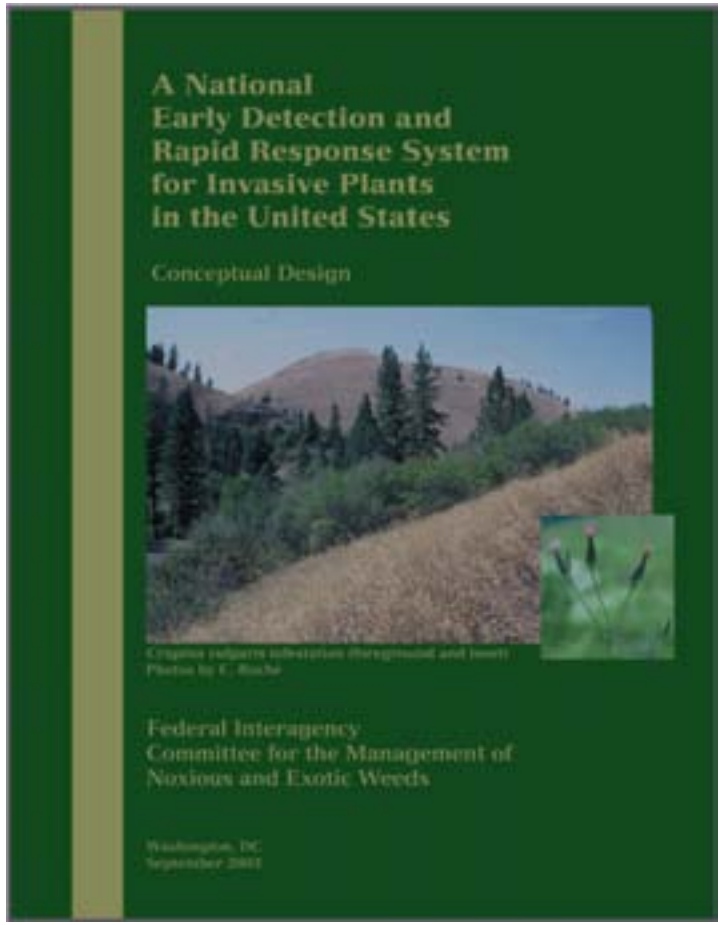
Maintenance and sustainability

Need to develop business models for:

- AZ-ISMap
  - core hardware, software, data, personnel, and services.
  - Technical approach to system maintenance and upgrades that corresponds to the sustainability plan of the network
- Member organizations
  - Data standards, data and metadata standards
  - QA/QC rating system
  - Security, privacy, and other data restrictions
- Usability
  - Development based on a user-driven approach (intensive, iterative user-oriented specification and usability assessment)
- Technology transfer
  - For example, leverage the Geospatial Extension Program and other potential partners (e.g. AGIC)

What's right (and wrong) about this picture?

On behalf of the 16-member Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), we are sincerely grateful to the many public and private contributors to the elements of this project since its beginning in 1998. The need for a national system to detect, assess, and respond to invasive species infestations in their early stages of establishment has energized FICMNEW to develop this conceptual design for such a system for invasive plants. With the rapidly growing threat from all invasive species, we are confident that this conceptual design can be a useful building-block for the eventual establishment of a broader early detection and rapid response system for all invasive species in the United States.

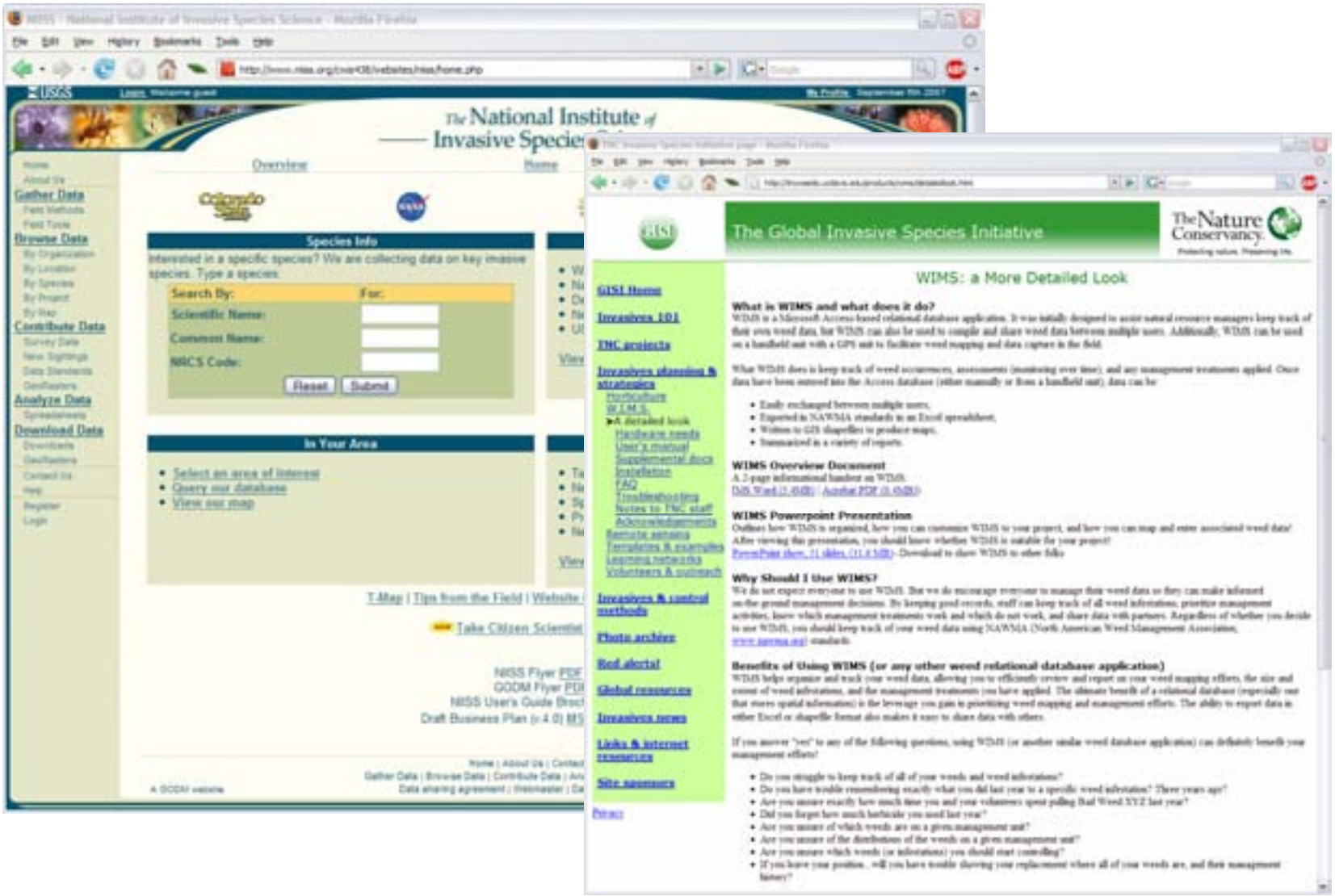


Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) 2003

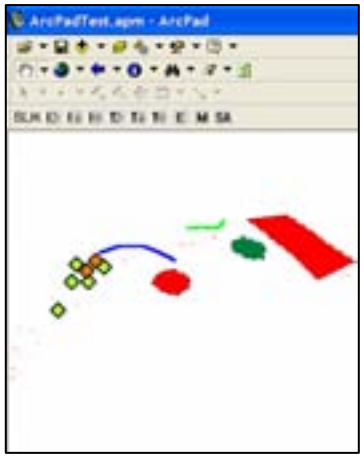
Problem

- Limited coordination limits access
  - Invasive species observations, effort tracking and the mapping of treatments are essential.
  - Data integration/sharing across organizations.
  - Excellent regional database (SWEMP), but not designed to address local coordination challenges.
  - **No coordinated method** to **capture/integrate/access/analyze/report** invasive species occurrences and treatments in Arizona that can address state-wide reporting needs while supporting local coordination needs.
- Limited interoperability limits effective use
  - Variability in data completeness
  - NO automated pipeline

Pieces of the puzzle (as seen from above)?



Pieces of the puzzle (as seen w/in one organization)



Selected screen shots from the BLM Invasive Species Management Information System (courtesy of Kathie Jewell)

Pieces of the puzzle (as seen from the ground)

Invaders of the Sonoran Desert Region
Plant Data Sheet

Recorder's Name: Marilyn Henson Date: 07/25/06 Time: 10:20a

Site Name: Southside of Brown Mt Site Number: 2

Slope*: F G M S C Aspect: S Elevation 867 m Dist to Water: - m Dist to Road: 100 m

Weather Conditions Sunny, Clear

Vegetation types
Chihuahuan Desert
Mohave Desert
✓ Arizona Upland Sonoran Desert
Lower Colorado Valley Sonoran Desert
Chaparral
Coniferous Forest
Oak woodland
Oak-pine woodland
Grassland
Water/Riparian Types
Riparian - marsh/oasis/cienega
Riparian – Lake/reservoir
Riparian - temporary water
Riparian - stream/river
Riparian – spring
✓ N/A

Landform
Ridgetop or mesa
✓ Rocky slope
Rocky slope with cliff
Rocky slope with talus
Canyon (in mountains)
Upper bajada
Lower bajada
Valley floor - rocky or gravelly
Valley floor - silty or sandy
Valley floor - floodplain
Wash - shallow or no banks
Wash - deep/steep banks
Sand dunes (or flats)

Site DB #:

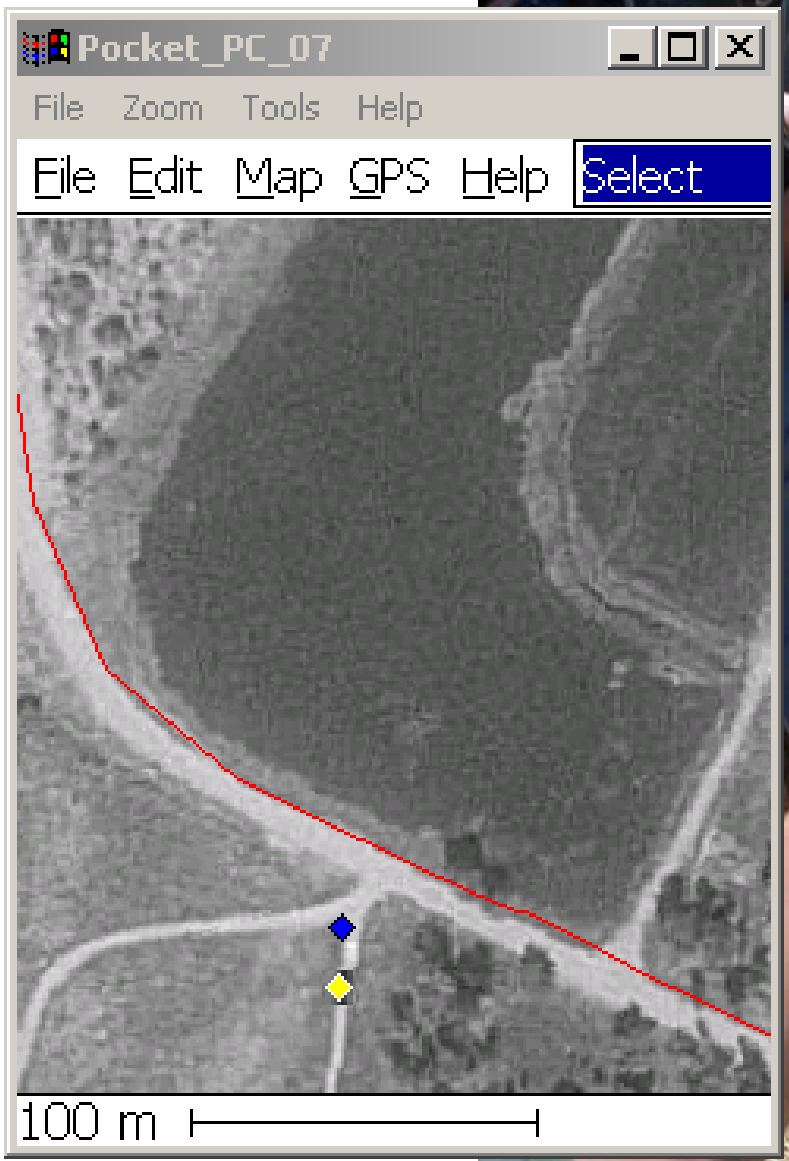
Disturbance
Recent Fire
Flood
Cleared
Urbanized
Roadside
Other-(describe in site notes)
None

Site Notes: Dottie Eaton

Species Observation

Species	A: Pencil Buffelgrass	B
Patch type	point size/shape:	point size/shape:
	line width:	line width:
	(polygon) shape: oval	polygon shape:
Location 1	Lat N 32 14 13.3 Long 111 09 53.4	Lat Long
Location 2	Lat 32 14 13.1 Long 111 09 51.3	Lat Long
Location 3	Lat 32 14 12.1 Long 111 09 50.5	Lat Long
Location 4	Lat 32 14 11.1 Long 111 09 50.0	Lat Long
Location 5	Lat 32 14 11.0 Long 111 09 57.3	Lat Long
Location 6	Lat 10.5 Long 52.8	Lat Long
Extent**	I L E (O)	I L E O
Percent cover***	<1 1-5 6-25 26-50 (50-75) 76-95 96-100 SP	<1 1-5 6-25 26-50 50-75 76-95 96-100 SP
Obs type****	C S	C S
Extends into natural habitat	(Y) N	Y N
Notes: Describe patch and abundance	32.14 11.3 111 09 54.9	
Obs ID #		

Making Maps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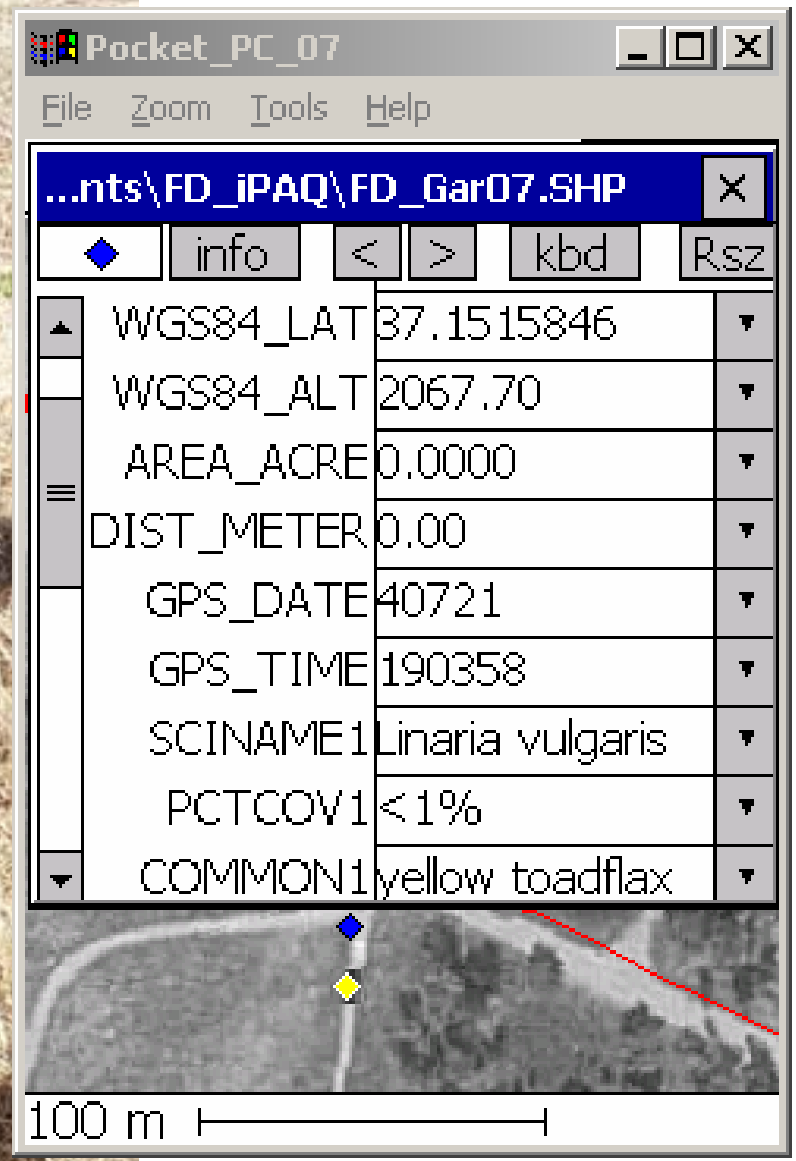
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DIST_METER 0.00
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GPS_TIME 190358
SCINAME1 Linaria vulgaris
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COMMON1 yellow toadflax
100 m

To Removal:

The Weedwackers Example

Photo: Marilyn Hanson

From local to regional/national and back!

The Data Pipeline

State Agencies

Tribes

NGO's

Federal Agencies

County Agencies

Interested Public

City governments

Local or Regional Databases

e.g. SWEMP
AZ-ISMap

CWMA

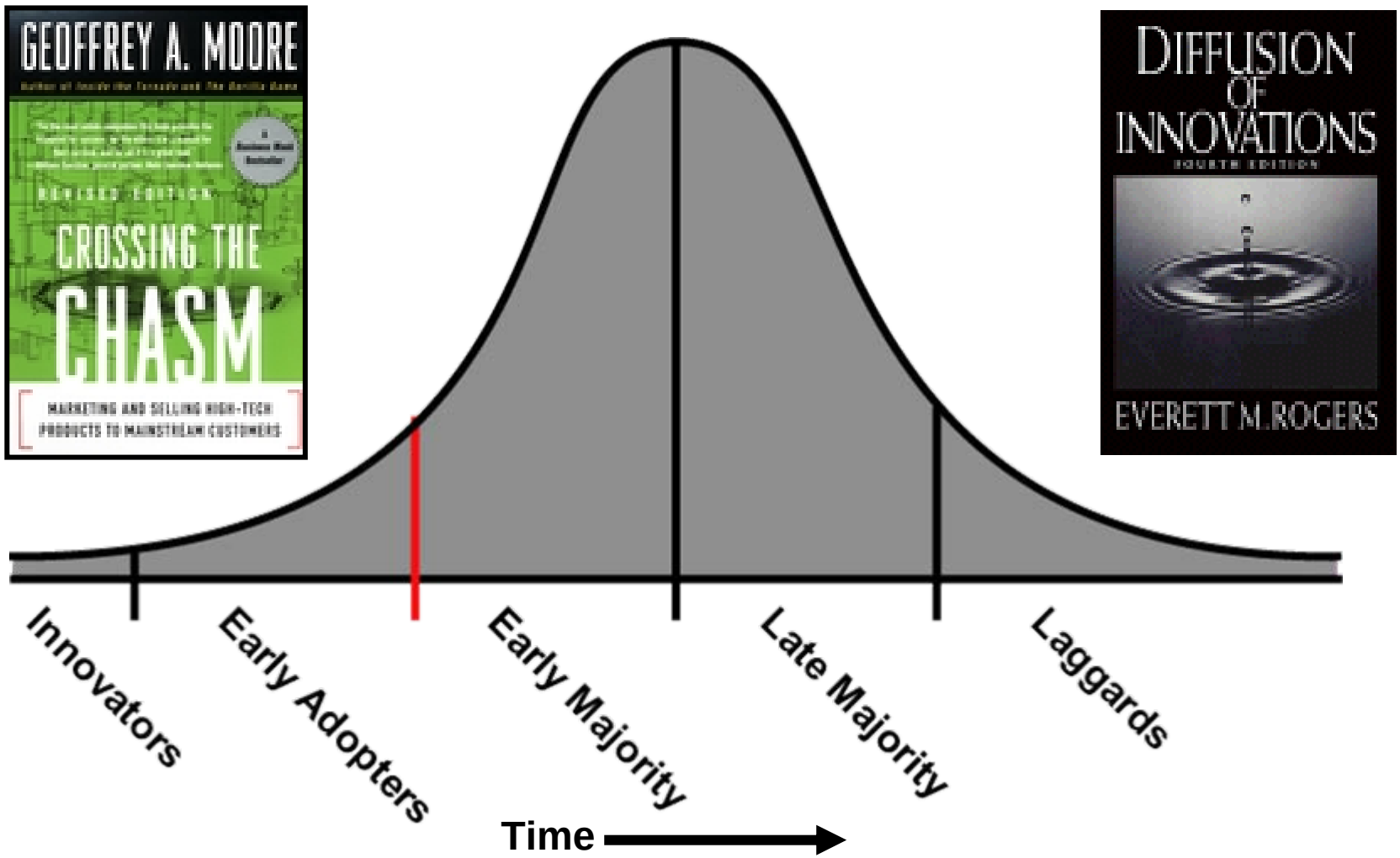
Forest Service NISIMS

BLM NISIMS ???

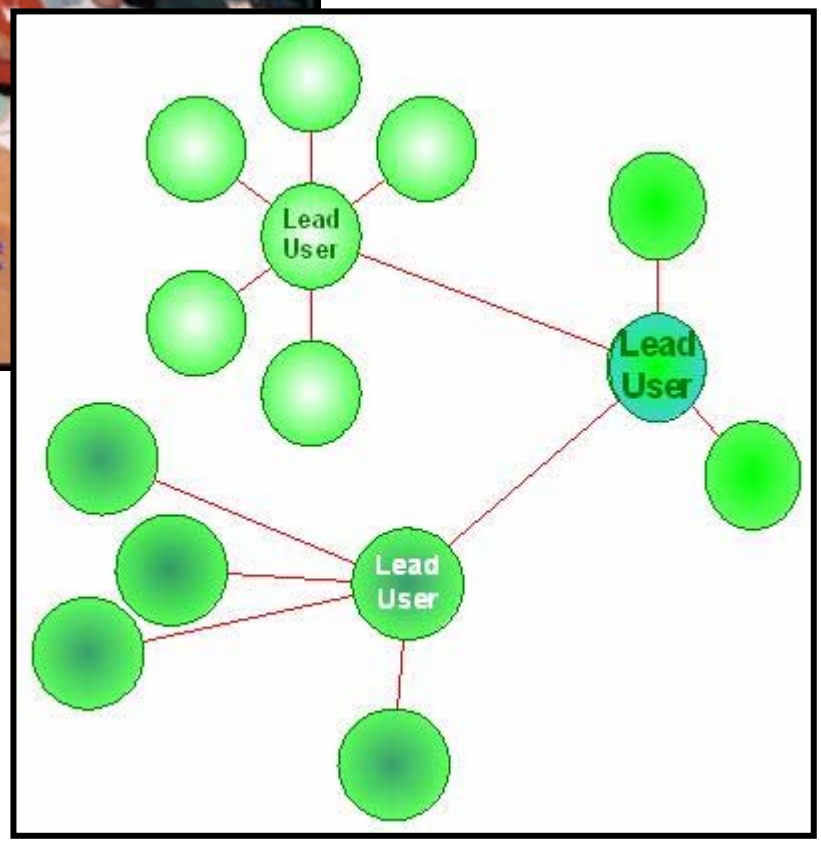
NIISS ???

Local ⟺ **Regional** ⟺ **National**

Translating Science and Transfering Technology



Diffusion: “Early Adopters” Influence Others



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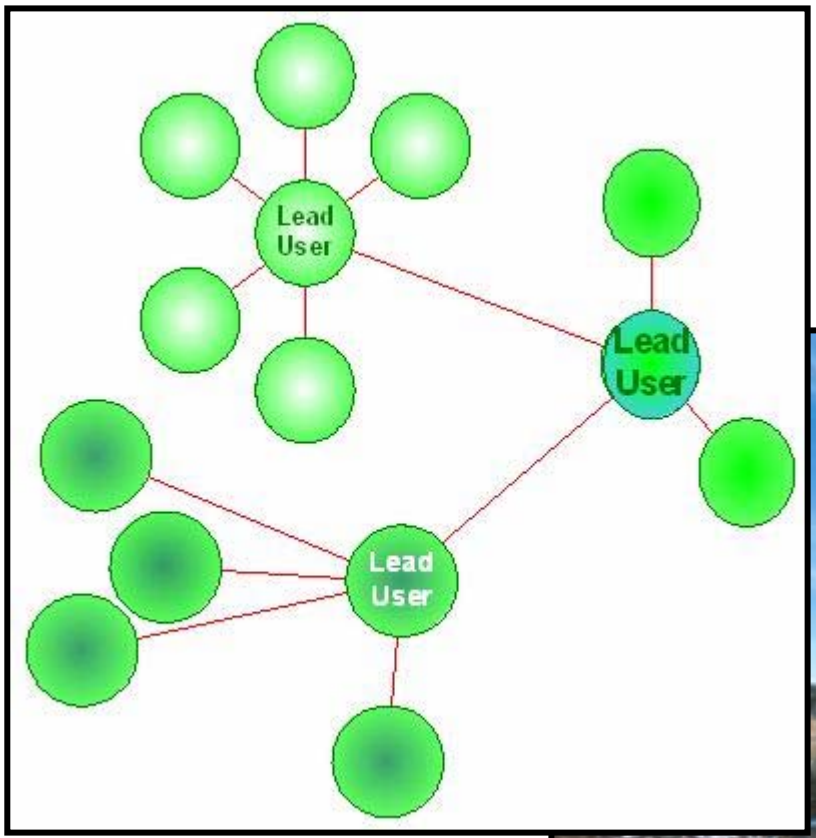


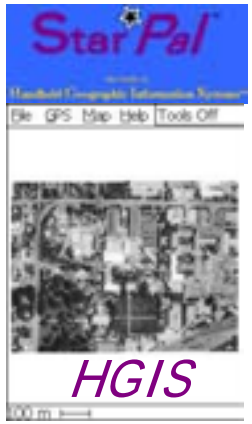
Two-way Knowledge Exchange: Outreach and *Inreach*

Enhanced decision support: Using MODIS & AVHRR for Ecological Forecasting
(RangeView October 2002 Workshop)

Integrating technologies for practical use

Geospatial Tool Kit

- Aerial photos/topos in background
  - TerraServer-USA.com
- GPS Receiver
  - Garmin GPSmap 60
- Handheld Computer
  - Hp iPAQ series PocketPC
- GIS on the handheld
  - StarPal HGIS, ESRI ArcPad
- GIS on the desktop or laptop
  - HGIS and ESRI ArcView



Equipment Options

























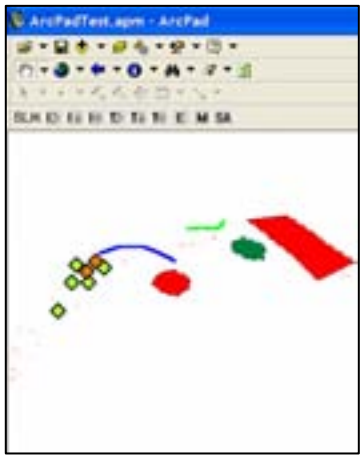
Recent GPS/GIS integrated solutions

Trimble Juno ST

HP iPAQ rx5915 Travel Companion

Both these units combine a Handheld Computer and a Integrated SiRFstarIII GPS receiver – the best integrated options we are aware of. You can add HGIS or ArcPad to each of these. The Juno ST sells for $650 and the iPAQ for $600 ($410 even!).

Software/Database Options



- What is the best system? The one you use!
  - The one most commonly used by your agency
  - The one that gets the job done

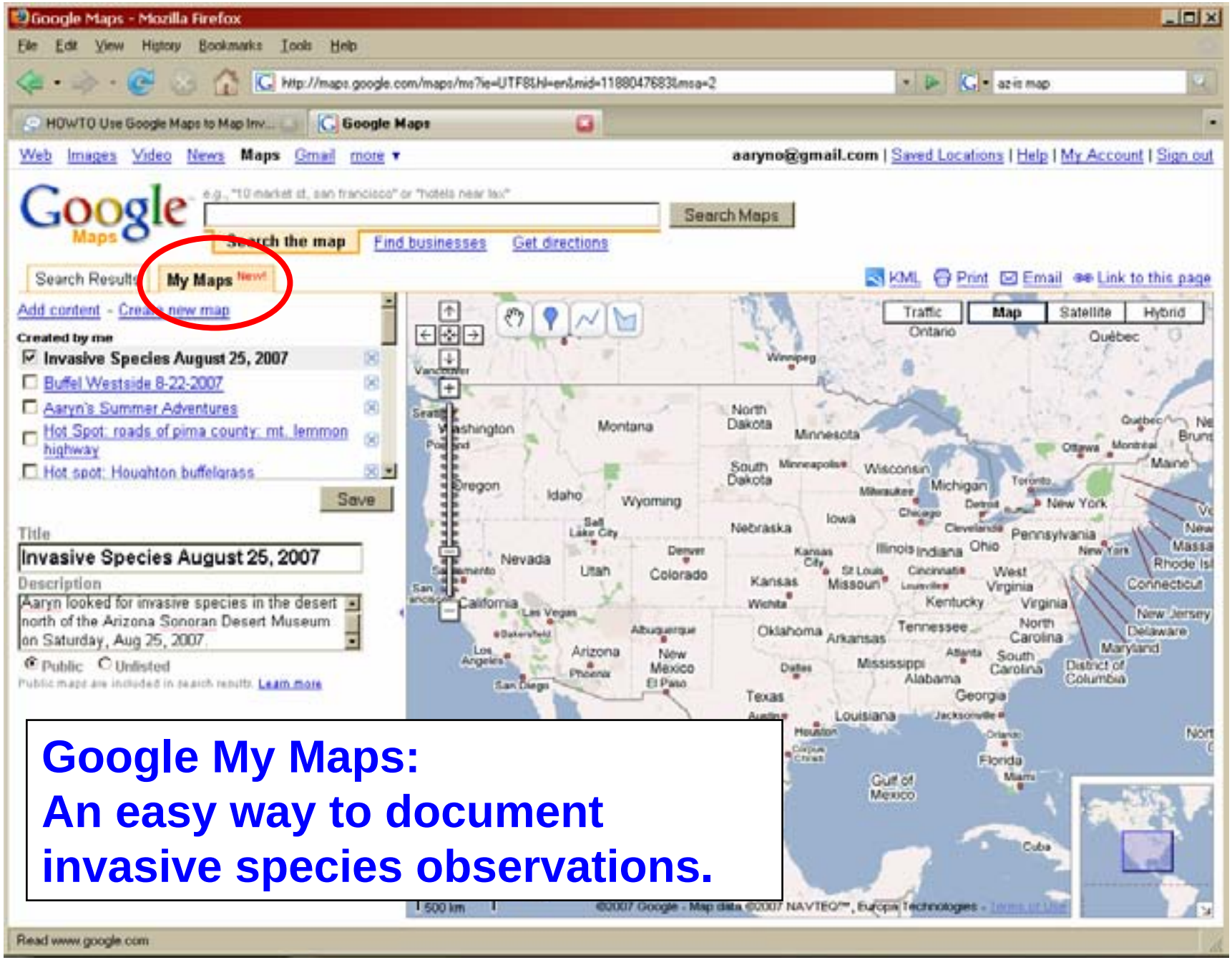
Selected screen shots from the BLM Invasive Species Management Information System (courtesy of Kathie Jewell)

The Future Is Now

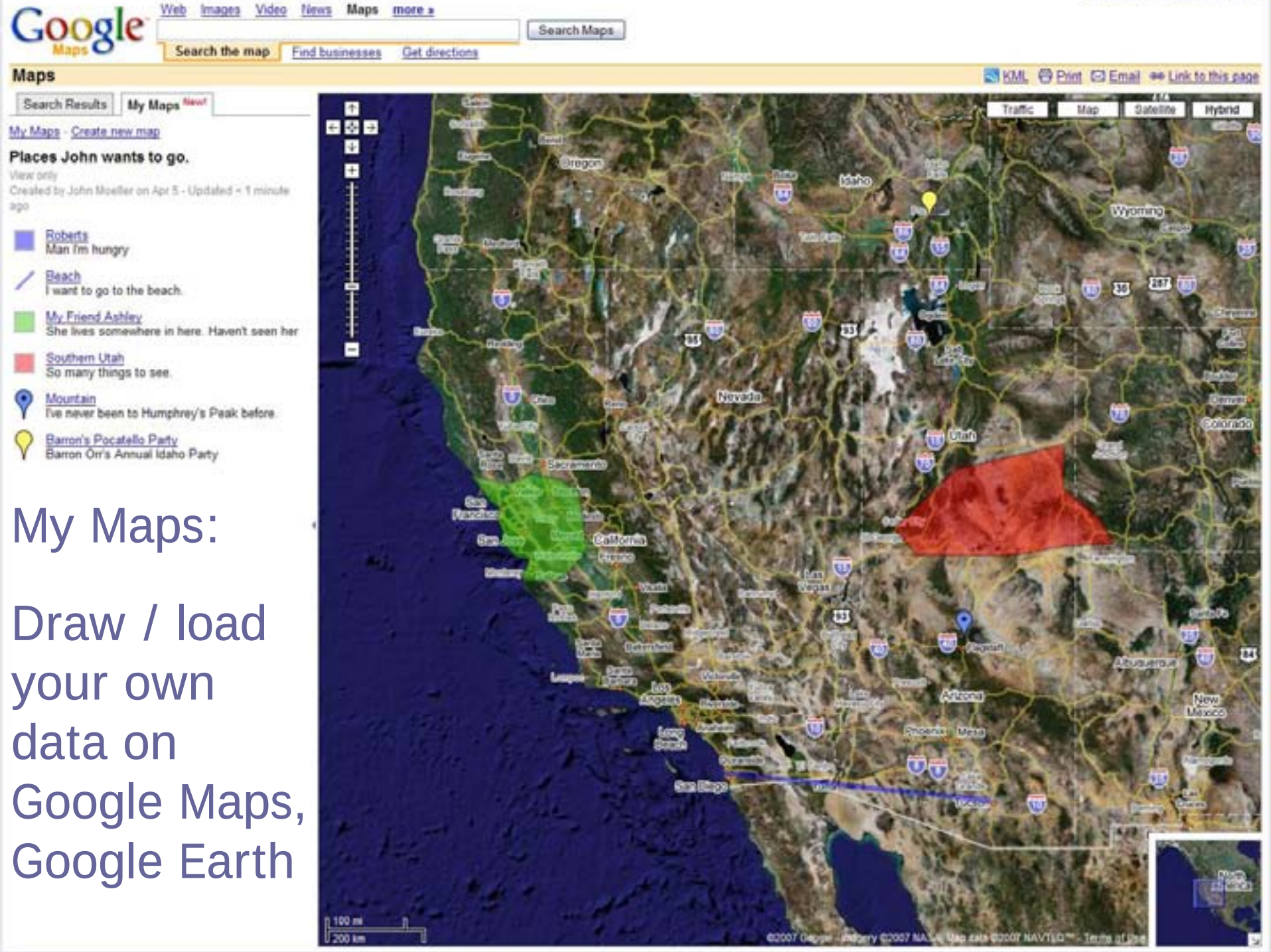
G3 Project - provides tracking, archiving and geotagging features, with the help of Google Maps and Google Earth, of any Java-capable mobile phone connected to a GPS receiver.

amAze - is for the Java-enabled mobile phone, which can provide and voice guidance to any destination; search or define any location by its address; search and navigate to businesses listed in yellow pages directories.

http://www.maps-gps-info.com/fgpfw.html

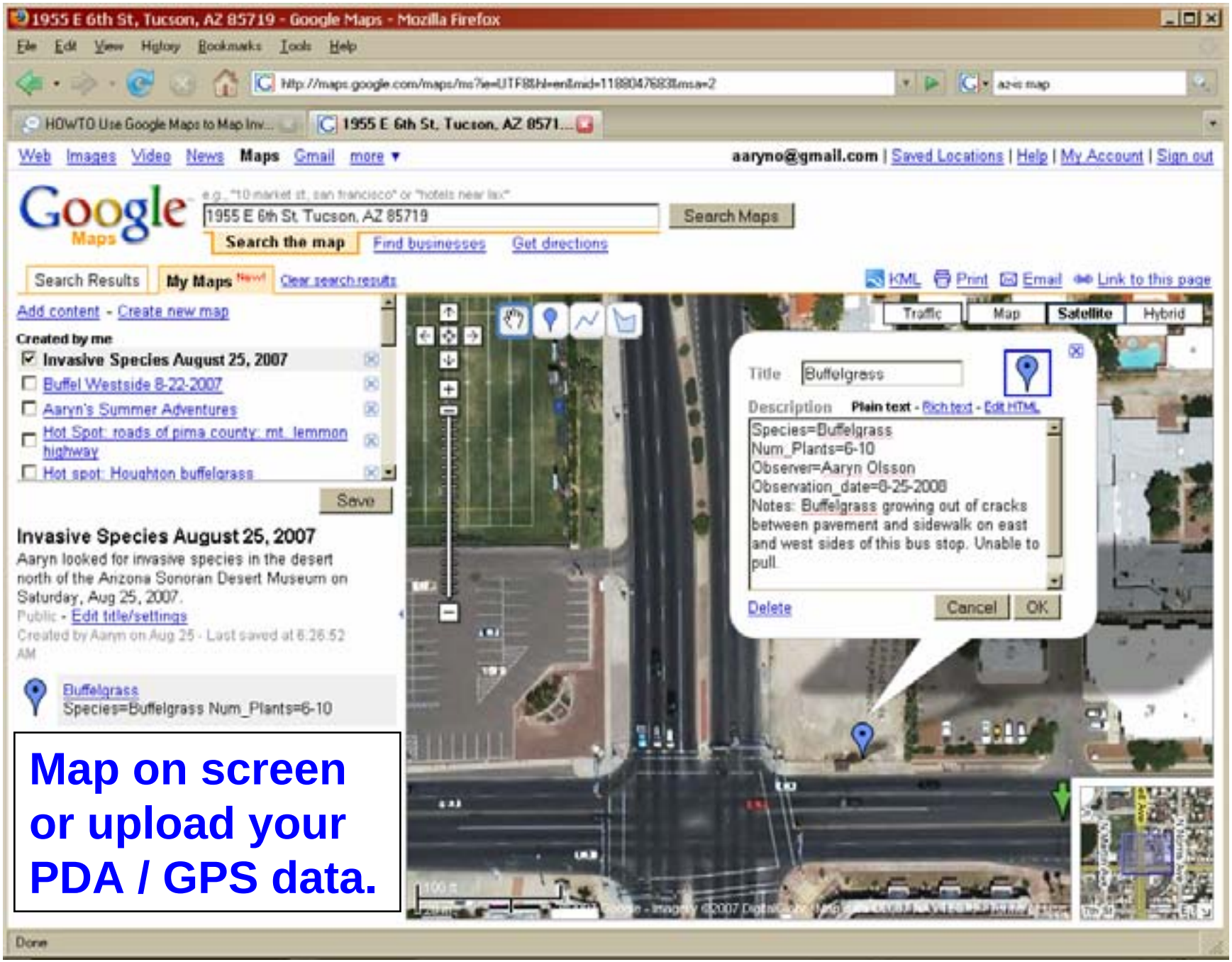


Google My Maps:
An easy way to document invasive species observations.

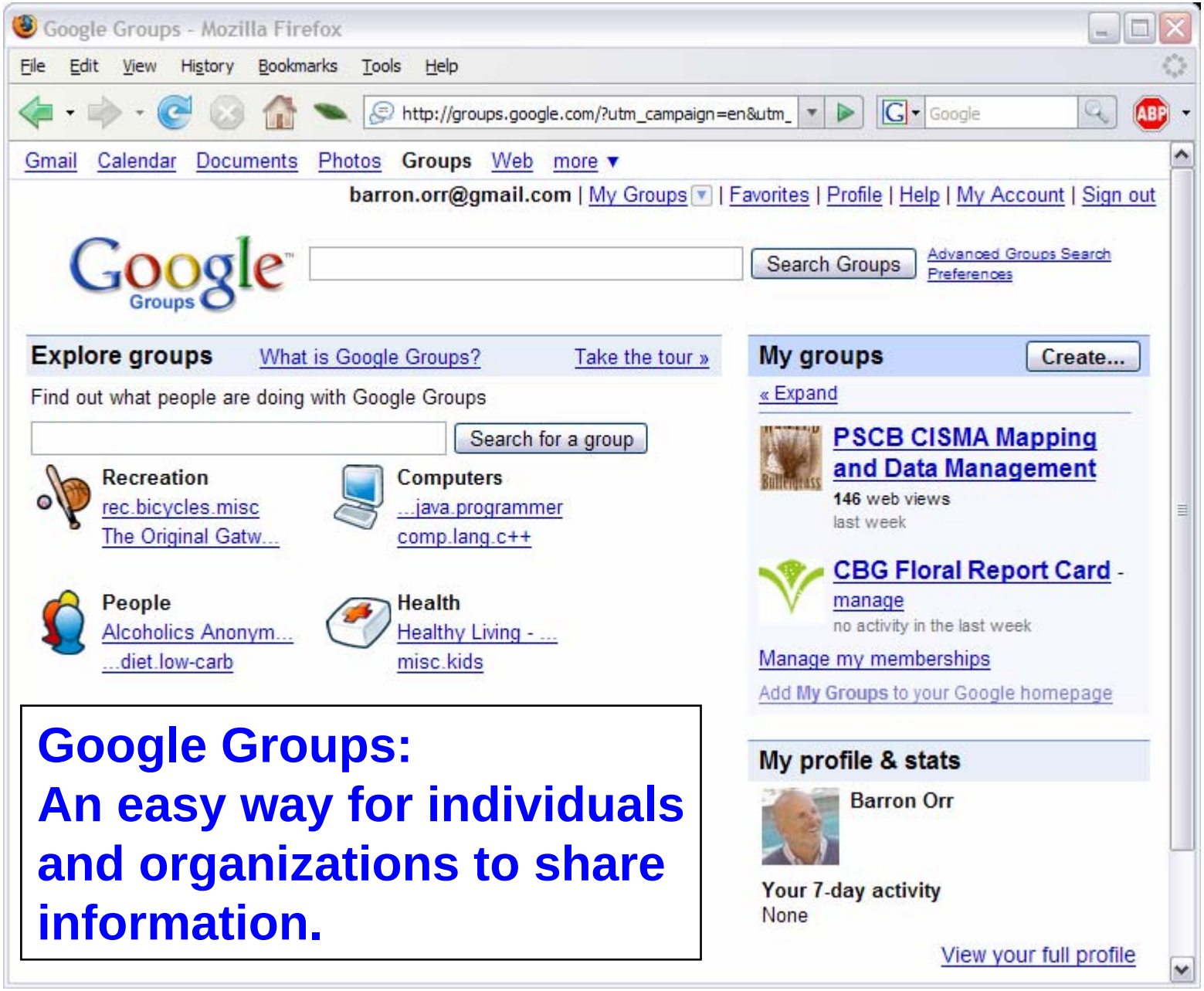


My Maps:

Draw / load your own data on Google Maps, Google Earth



Map on screen or upload your PDA / GPS data.


Google Groups - Mozilla Firefox
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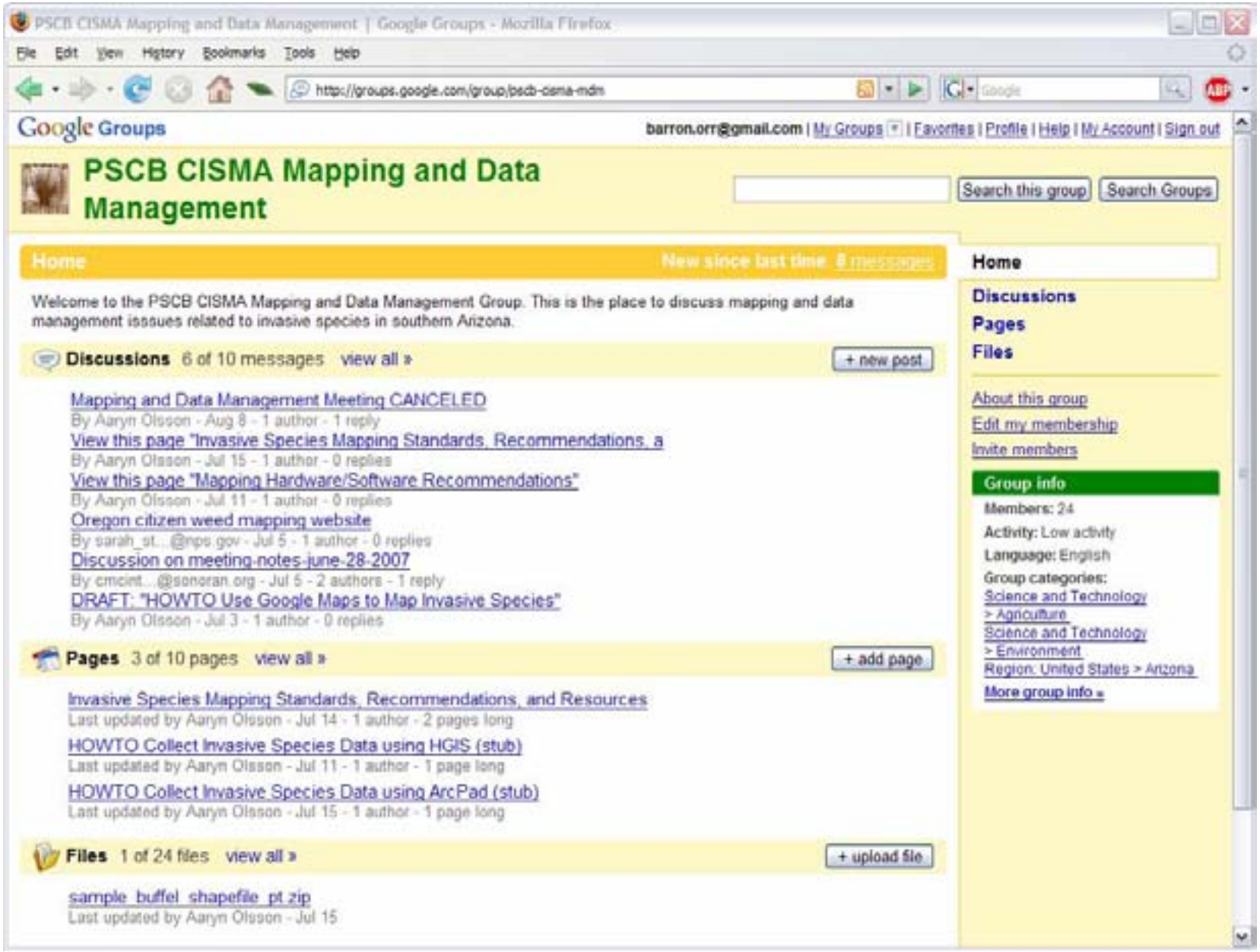
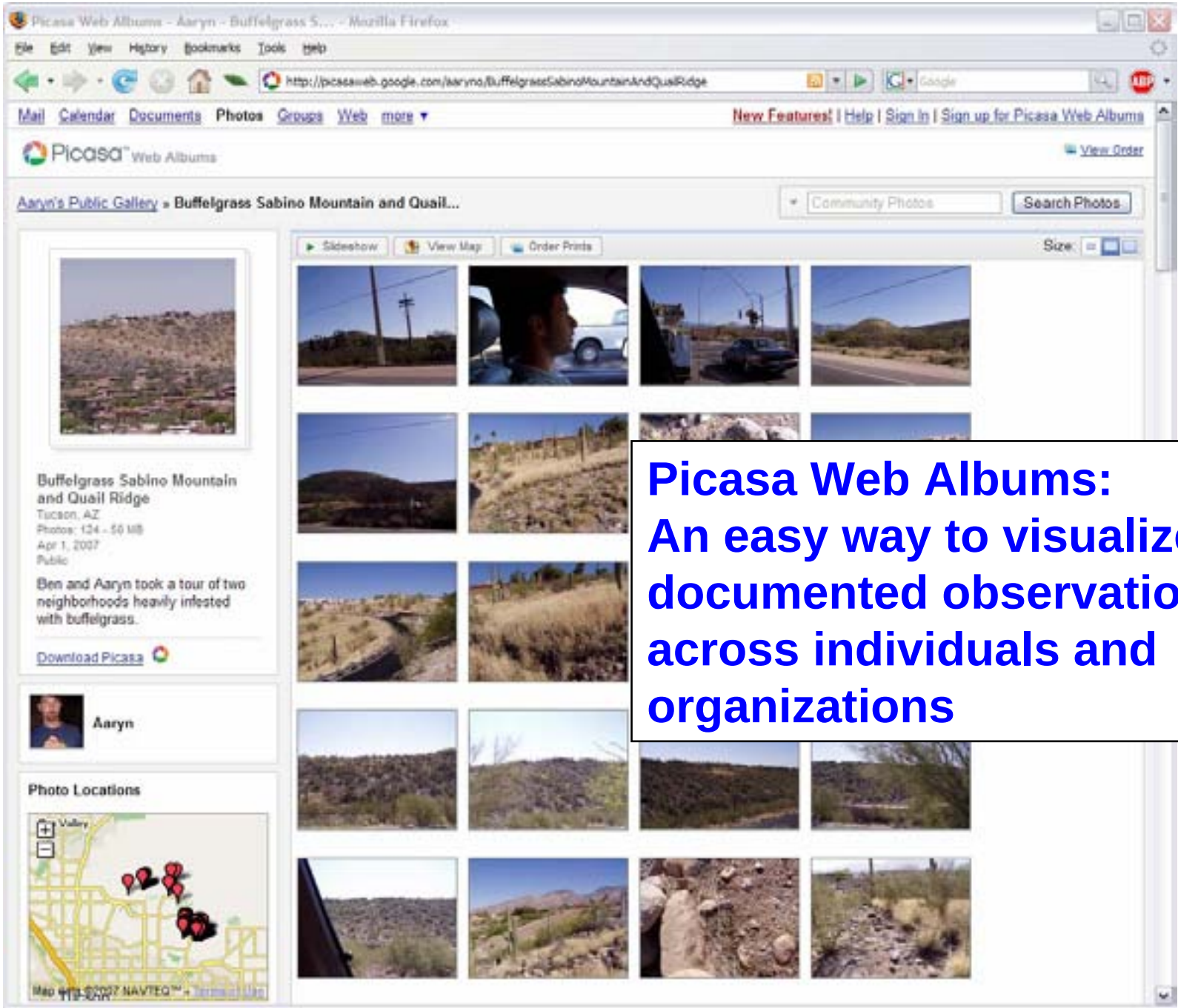
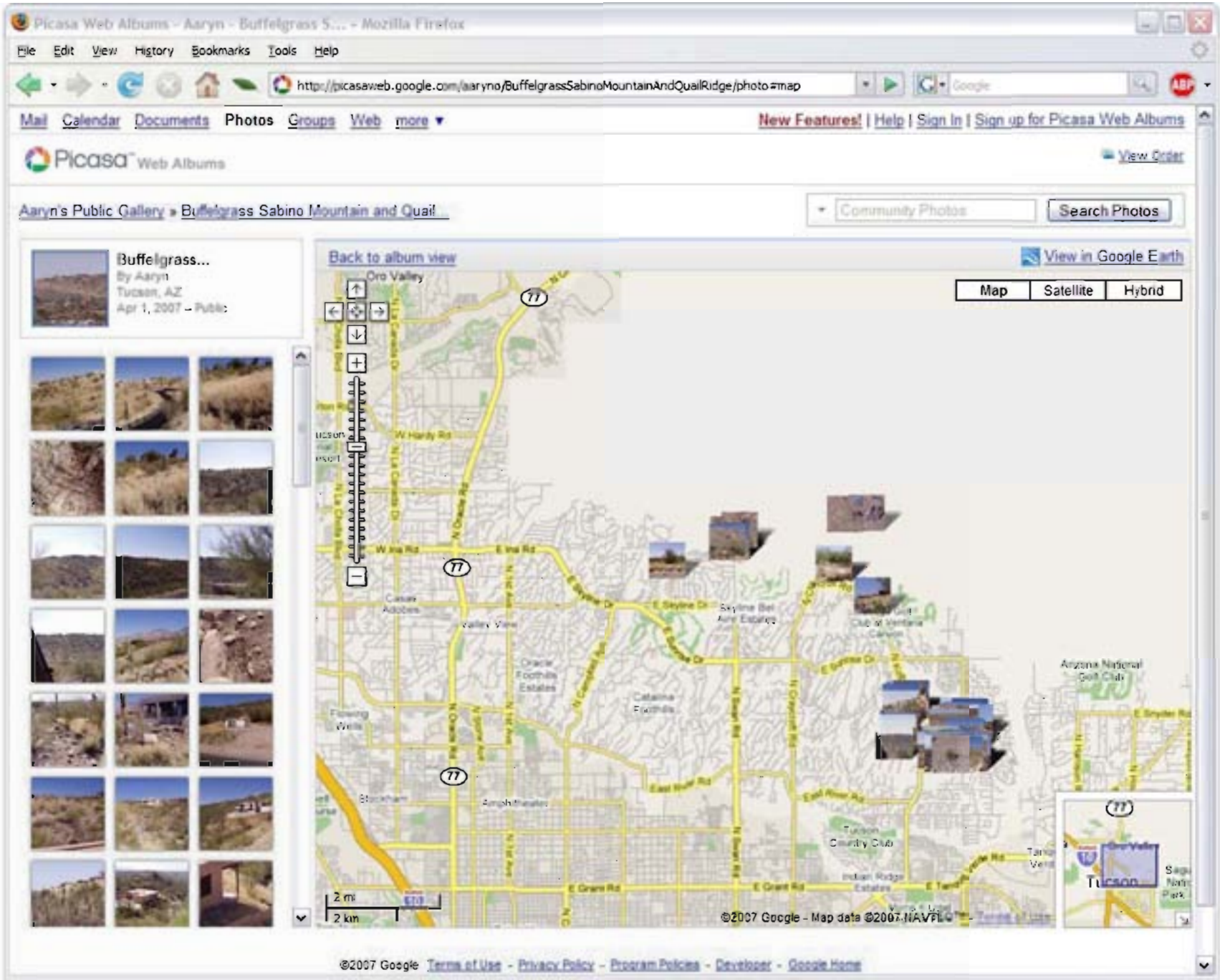
barron.orr@gmail.com | My Groups | Favorites | Profile | Help | My Account | Sign out
Google Groups
Search Groups
Advanced Groups Search
Preferences
Explore groups
What is Google Groups?
Take the tour »
Find out what people are doing with Google Groups
Search for a group
Recreation
rec.bicycles.misc
The Original Gatw...
Computers
...java.programmer
comp.lang.c++
People
Alcoholics Anonym...
...diet.low-carb
Health
Healthy Living - ...
misc.kids
My groups
Create...
« Expand
PSCB CISMA Mapping and Data Management
146 web views
last week
CBG Floral Report Card - manage
no activity in the last week
Manage my memberships
Add My Groups to your Google homepage
My profile & stats
Barron Orr
Your 7-day activity
None
View your full profile
Google Groups:
An easy way for individuals and organizations to share information.



Pima-Santa Cruz Basin Cooperative Invasive Species Management Area's "Group"



Picasa Web Albums:
An easy way to visualize documented observations across individuals and organizations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Tucson, AZ
Apr 1, 2007 – Public
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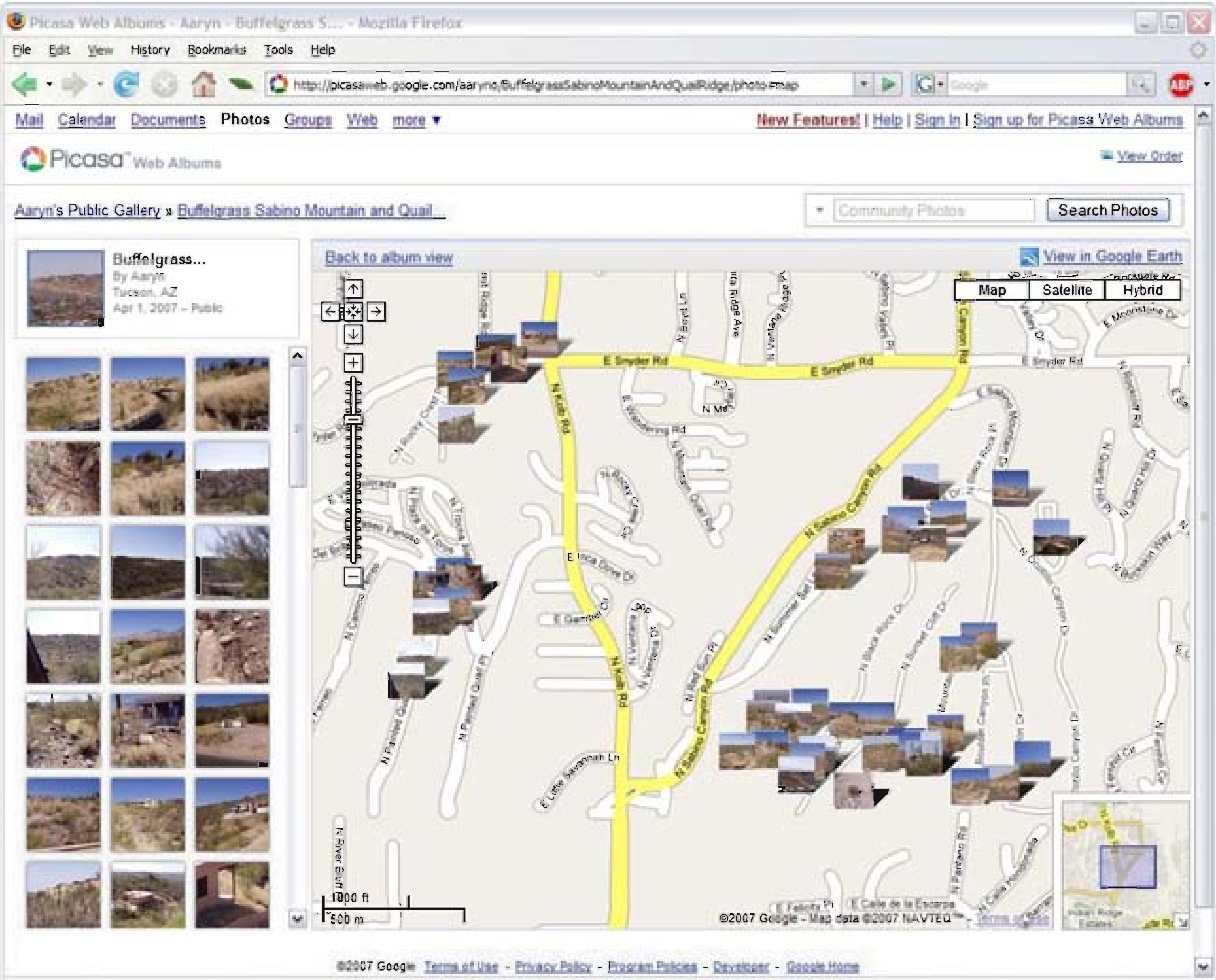

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Mail Calendar Documents Photos Groups Web more
New Features! | Help | Sign In | Sign up for Picasa Web Albums
Picasa Web Albums
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Aaryn's Public Gallery » Buffelgrass Sabino Mountain and Quail...
Community Photos
Search Photos
Buffelgrass...
By Aaryn
Tucson, AZ
Apr 1, 2007 – Public
Back to album view
View in Google Earth
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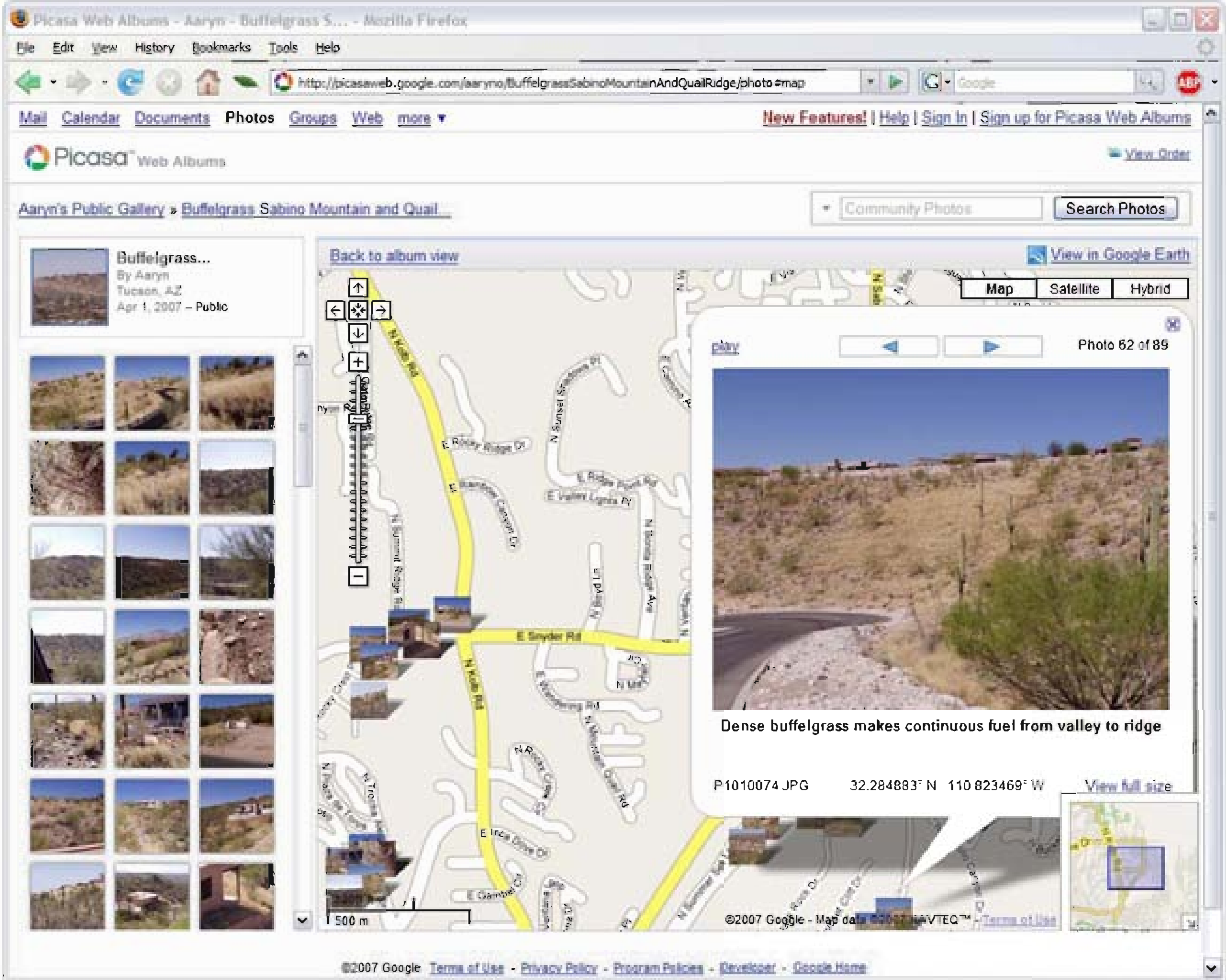
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New Features! | Help | Sign In | Sign up for Picasa Web Albums
Picasa Web Albums
View Order
Aaryn's Public Gallery » Buffelgrass Sabino Mountain and Quail...
Community Photos
Search Photos
Buffelgrass...
By Aaryn
Tucson, AZ
Apr 1, 2007 – Public
Back to album view
View in Google Earth
Map
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Photo 62 of 89
Dense buffelgrass makes continuous fuel from valley to ridge
P1010074.JPG
32.284883° N 110.823469° W
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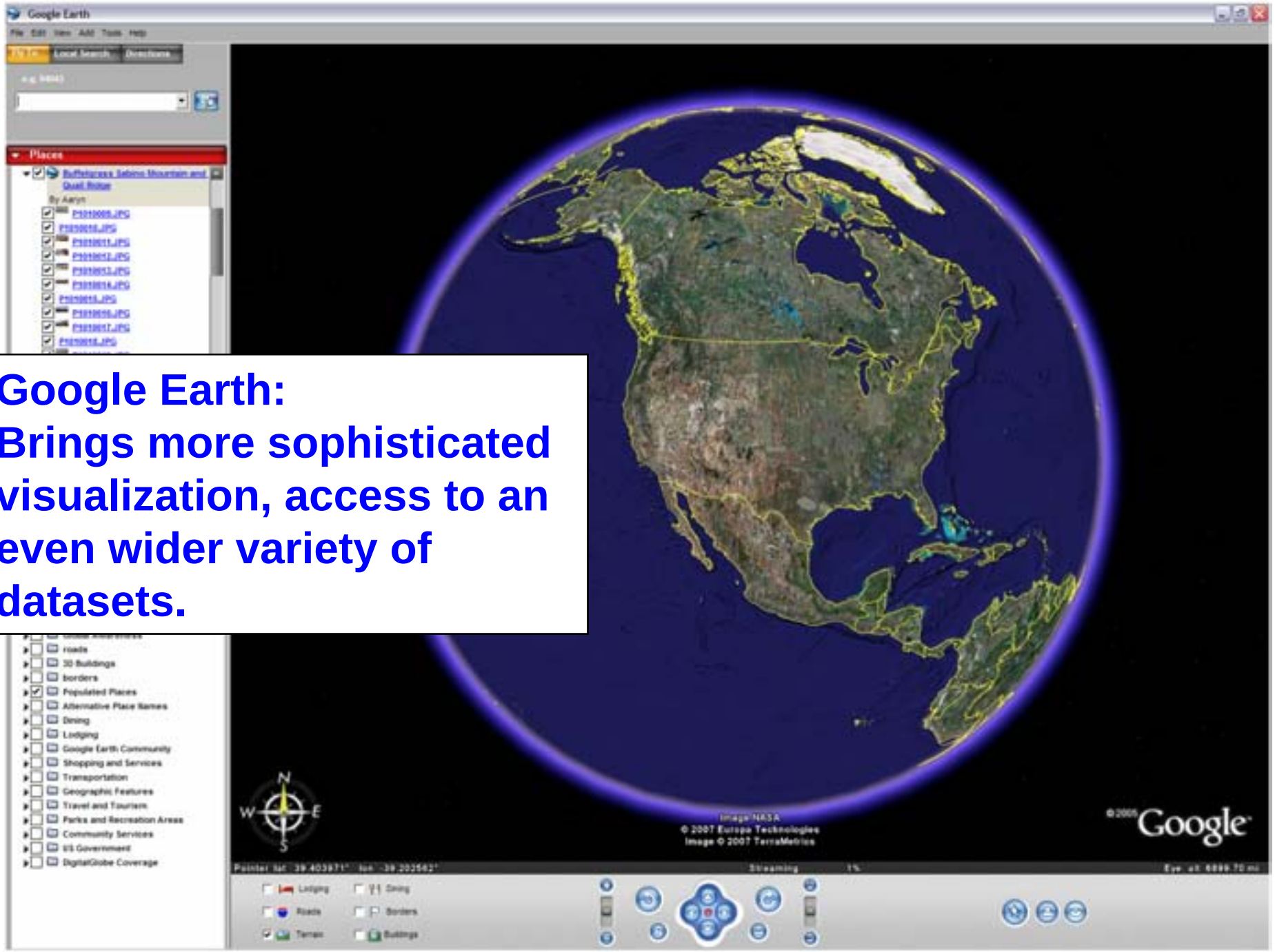
Google Earth
Places
Google Earth:
Brings more sophisticated visualization, access to an even wider variety of datasets.
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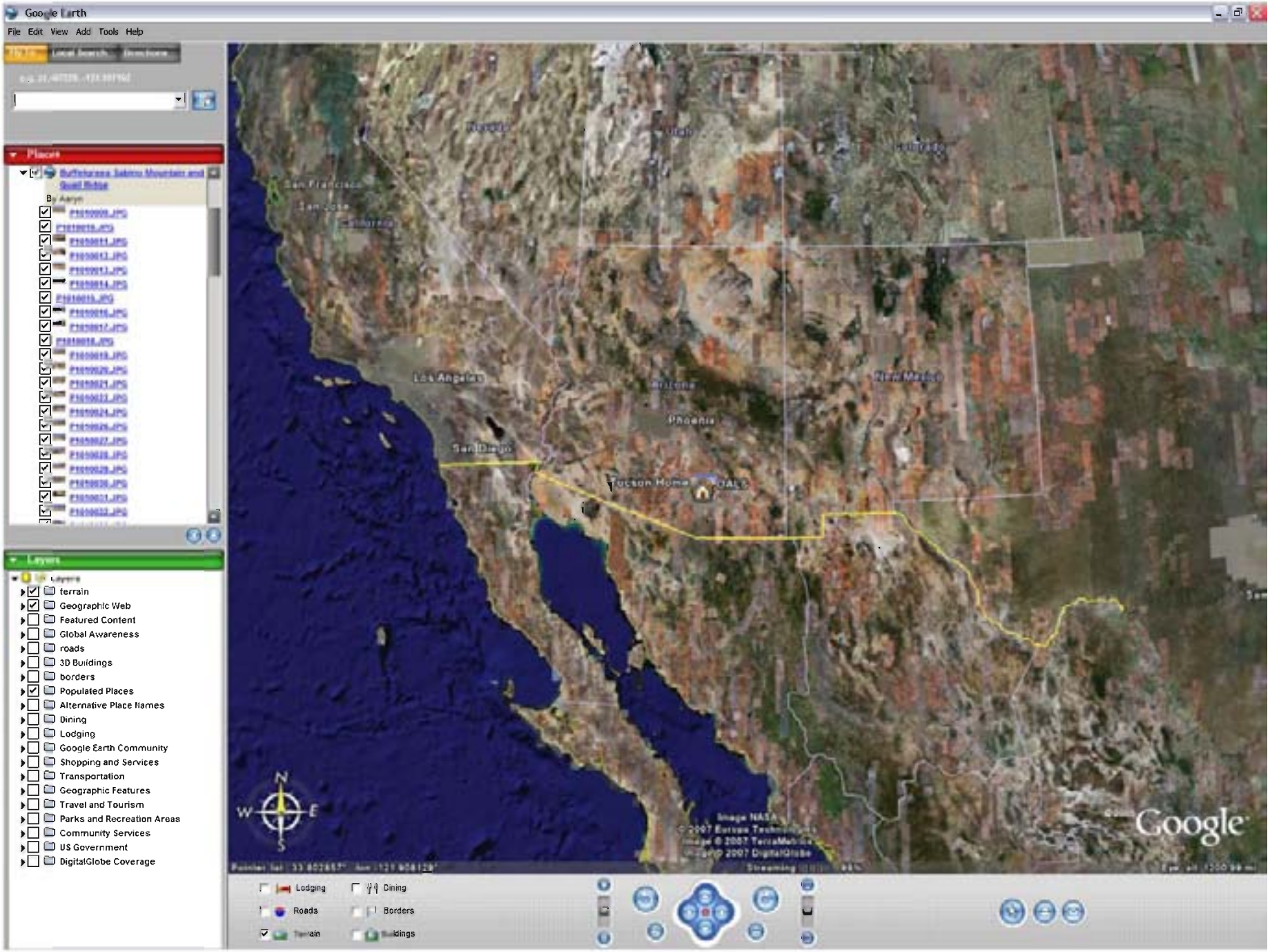
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Geographic Web
Featured Content
Global Awareness
roads
3D Buildings
borders
Populated Places
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Dining
Lodging
Google Earth Community
Shopping and Services
Transportation
Geographic Features
Travel and Tourism
Parks and Recreation Areas
Community Services
US Government
DigitalGlobe Coverage
Los Angeles
San Diego
Phoenix
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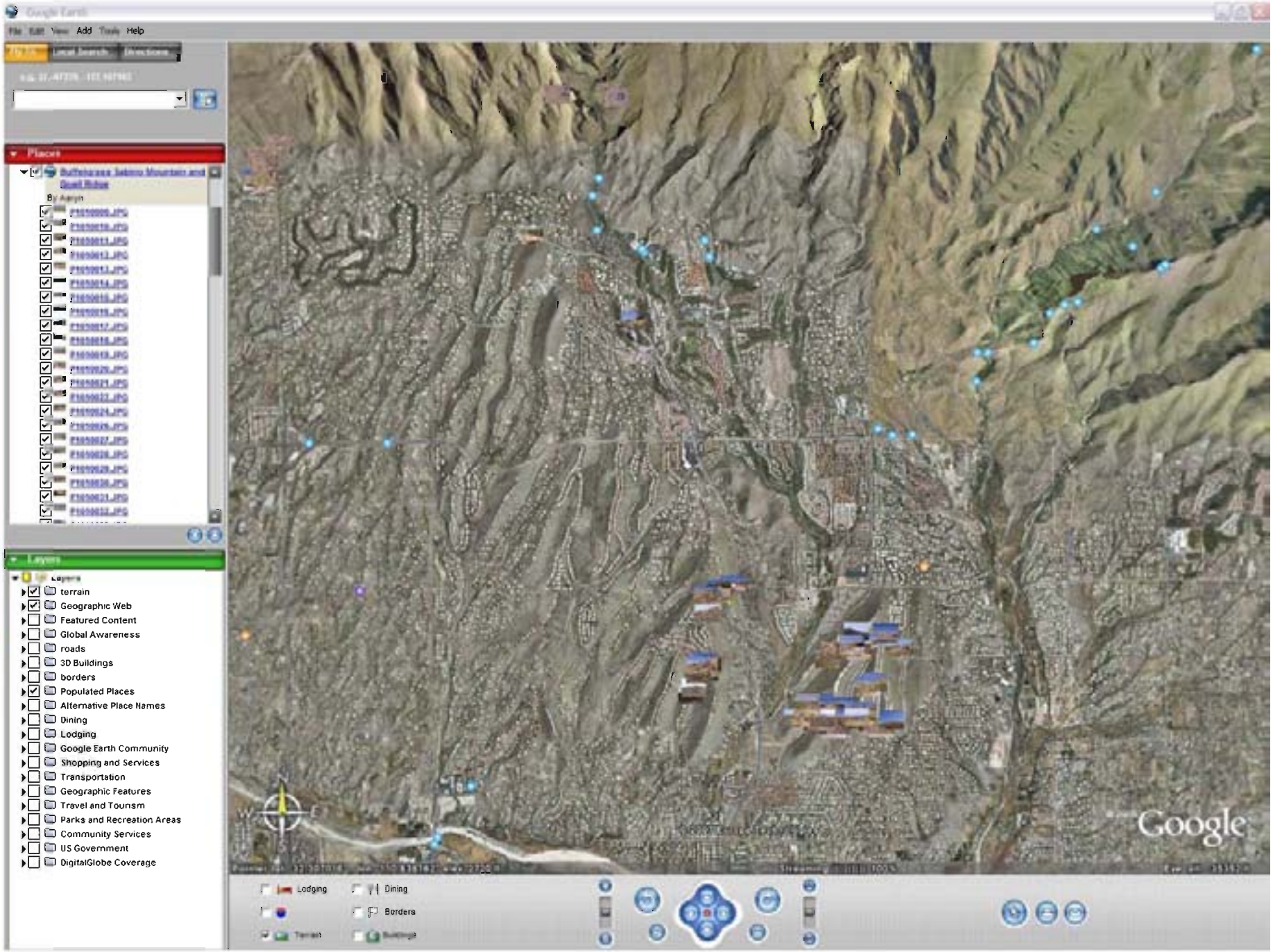
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US Government
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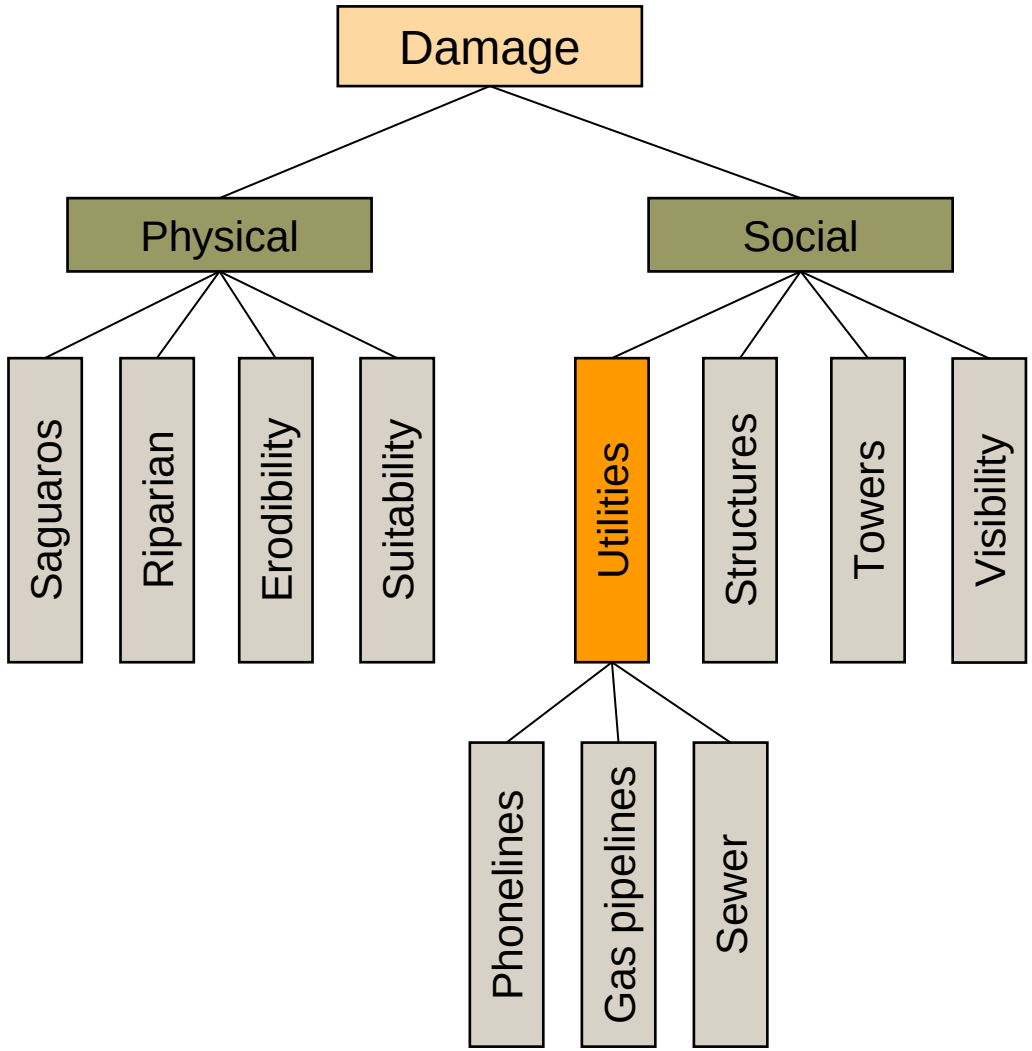
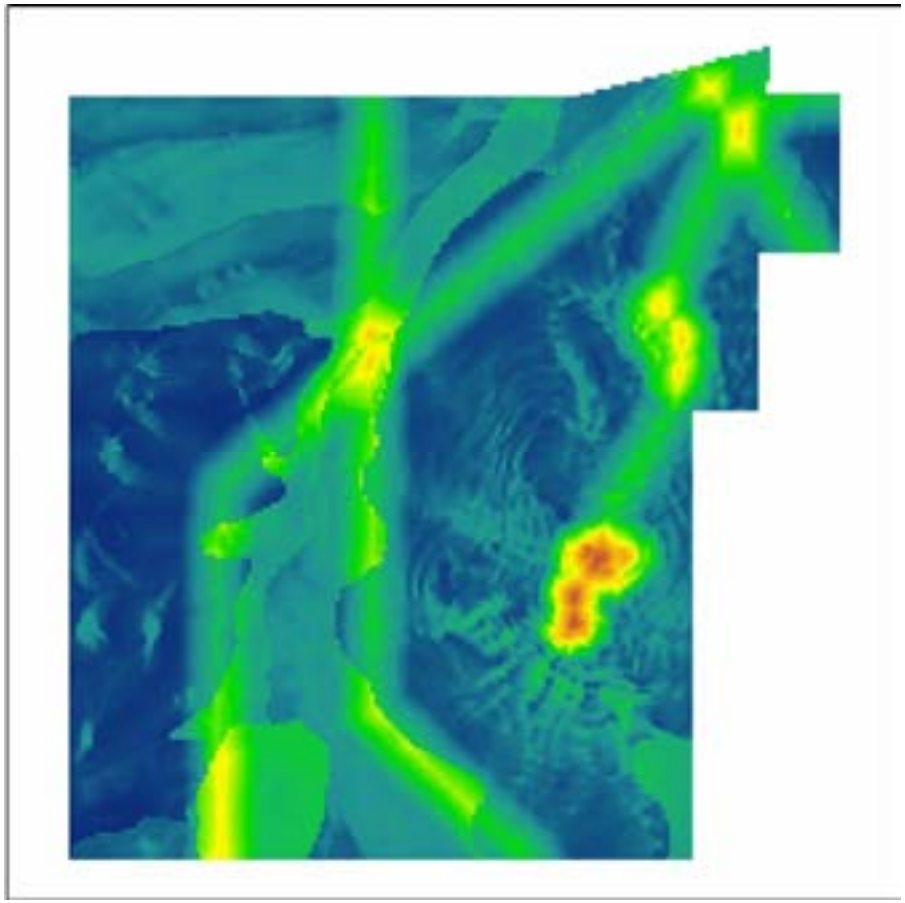
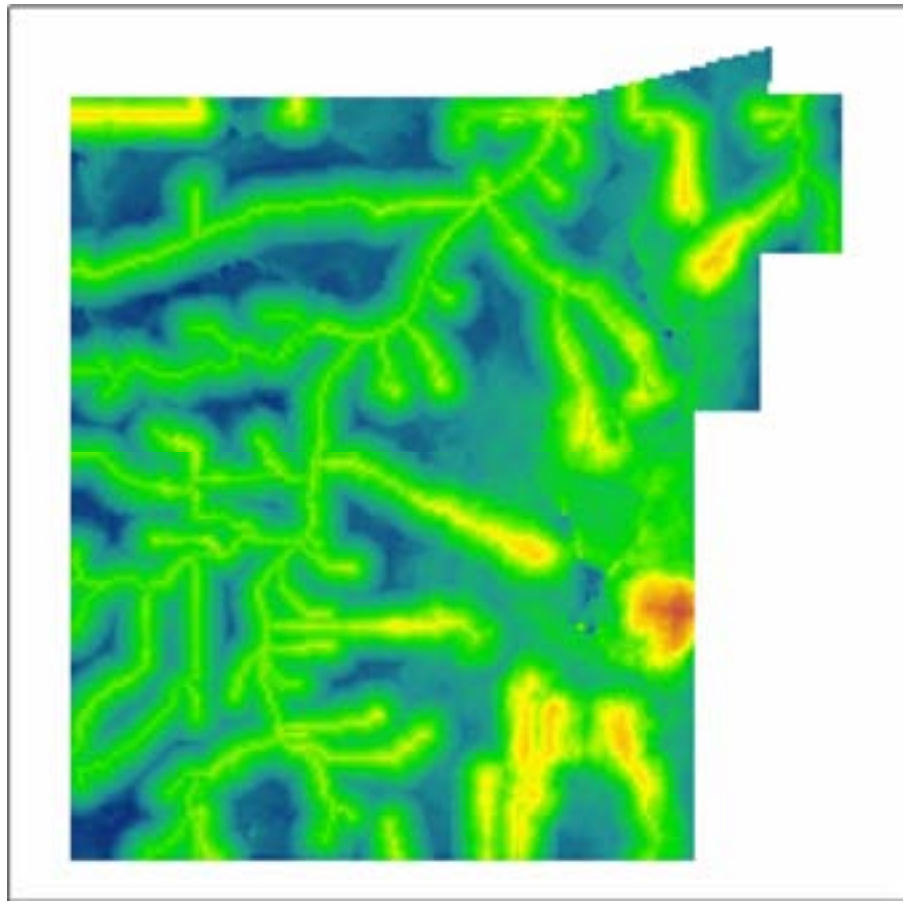
Decision support

Aaryn Olsson, George Frisvold, Julio Betancourt, Travis Bean, Stuart Marsh and I are working on a USDA-ERS PREISM grant proposal to create a decision support system for buffelgrass in Pima County. The aim of the project is to first integrate social and physical factors (i.e., risk and values at risk) as well cross-organizational resources and restrictions. Our hope is the result will be a decision support tool that can help us bring mapping and documentation more realistically in cross-jurisdictional decision making and mitigation efforts.



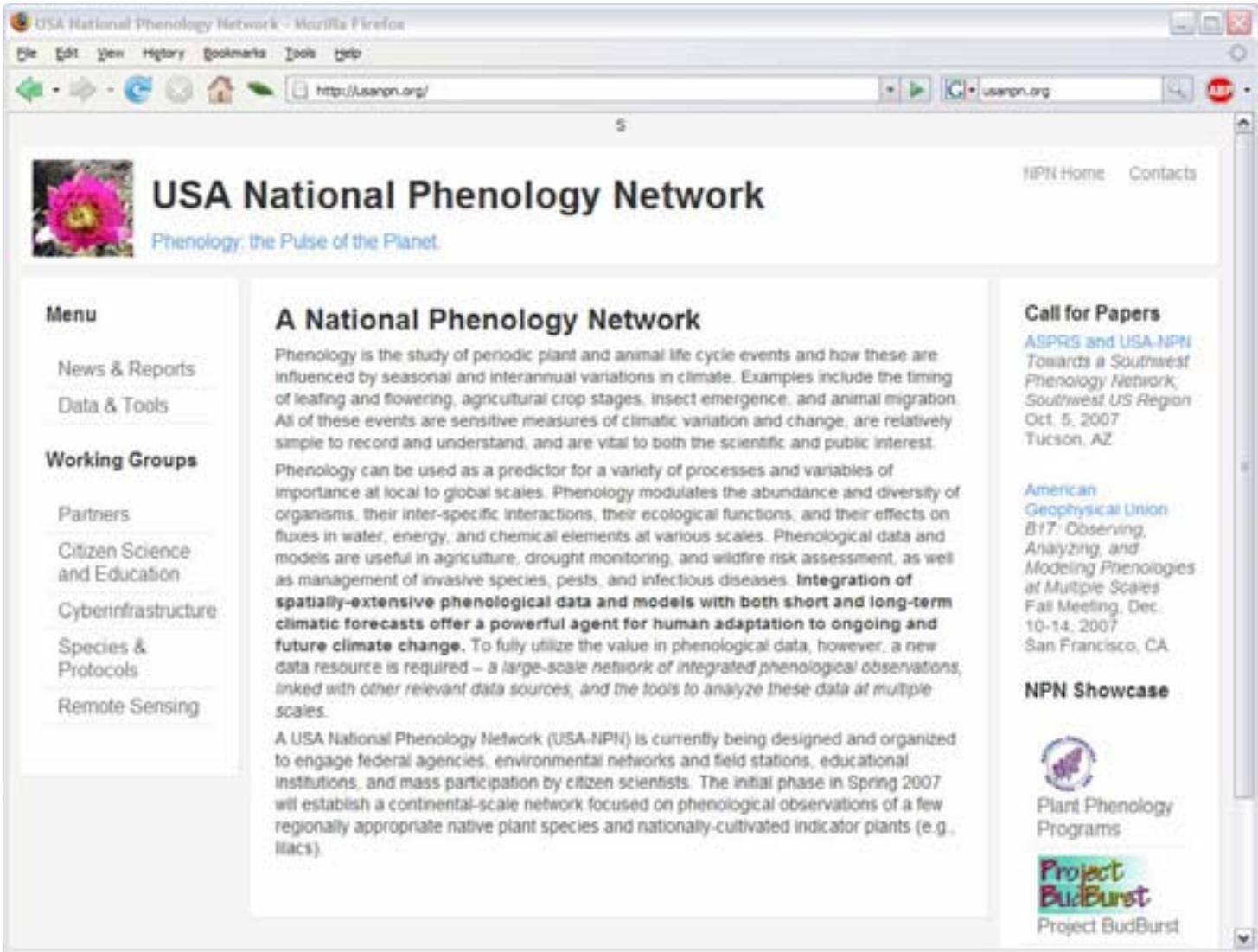
Decision support





Trial run of a buffelgrass decision support system using Tumamoc Hill data. On the left, infrastructure is given higher consideration. On the right, the ability to view saguaro is given higher consideration.

Leverage synergistic activities



The National Phenology Network
http://usanpn.org/

Citizens science

Thomas Litson,
Grazing Committee Chair,
Tsaile-Wheatfields Chapter,
Navajo Nation

Laura Baker,
NASA Space Grant
Undergraduate Intern

Thank You!

Barron J. Orr

Tani A. Hubbard